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Lobbying Derails Bills on DNA Regulation

Legislation to control recombinant DNA research in the United States has run into heavy lobbying, and has become so enmeshed in procedural difficulties in the House and Senate that there is virtually no chance Congress will complete action on it this year.

The latest twists and turns in the recombinant DNA saga have left many onlookers confused about what is going on, while many of the participants are frustrated at the vagaries of the legislative process. In short, the situation is a mess.

The last time we reported on Congressional activities concerning recombinant DNA legislation (SGR Vol. VII, No. 14), a bill sponsored by Senator Edward Kennedy (D-Mass.) was awaiting a vote in the Senate, and a bill sponsored by Rep. Paul Rogers (D-Fla.) was about to be considered by the House Commerce Committee, having already cleared Rogers' health subcommittee. By early October, however, Kennedy had withdrawn his bill, and the House Commerce Committee still hadn't taken up the Rogers version for consideration.

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Let us begin with the strange series of events on the Senate side: Kennedy's bill (S.1217) was approved with very little debate by the Senate Committee on Human Resources back in June, and it was on the Senate Calendar awaiting floor debate before the summer recess. The bill, which would have established a presidentially appointed commission to draft new rules for recombinant DNA experiments and oversee their implementation, met with strident opposition from a number of biological scientists, however. Petitions protesting the bill were circulated at two scientific conferences during the summer, and letters and telephone calls started coming into the offices of several key Senators.

As a result, Senators Gaylord Nelson (D-Wisc.) and Daniel Moynihan (D-NY) introduced a less restrictive bill in early August, and announced they would offer it as an amendment when the Kennedy version was brought up for a vote. Score one for the scientific lobby.

The next move came in late September, when Senator Adlai Stevenson (D-Ill.) announced he also had reservations about the way the legislation was shaping up; he suggested that it would be best to delay a vote until next year. Stevenson also announced that he would hold hearings on recombinant DNA research with his Commerce Subcommittee on Science, Technology and Space on November 2, 3, and 10. Score another one for the scientific lobby and one for congressional committee rivalries.

A few days later, Kennedy abruptly withdrew his support for S.1217, and announced that he would try to set up a committee to advise him on whether new legislation is needed. In the meantime, Kennedy said he would seek a bill which would simply extend the existing NIH guidelines to industry, since they now are binding only on NIH-supported activities and those supported by other federal agencies that accept the NIH rules.

Kennedy aides then drafted a three-page bill and began circulating it for comments. Since the bill contained no provisions for monitoring or enforcing the regulations, it attracted little support, however. In particular, officials from both NIH and the Office of Science and Technology Policy told Kennedy that the Administration stands by the bill which was drafted by the Department of Health, Education, and Welfare last

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In Brief

The Senate Subcommittee on Science, Technology and Space is planning extensive oversight hearings on the operations of the White House Office of Science and Technology Policy. Chairman Adlai Stevenson (D-Ill.) has notified OSTP Director Frank Press that he is scheduling the hearings for February, and expects to examine the "implementation of provisions under the Act" that created OSTP and "to review the status of US science and technology efforts."

Stevenson, who unsuccessfully challenged President Carter's reorganizational paring down of OSTP, also told Press that he plans to look into what's happened to some of the functions that were removed from OSTP's jurisdiction, such as preparation of a five-year "outlook" report on science and technology, and operation of several advisory committees.

A final *Report and Recommendations: Research Involving Children* has been forwarded to the Secretary of HEW by the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. Copies are available without charge from the Public Information Officer, National Commission for the Protection of Human Subjects, Room 125, Westwood Building, Bethesda, Md., 20016. Tel. (301) 496-7776.

. . . House DNA Bill Suddenly Blocked

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spring. Kennedy aides were said to be trying to work out a revised compromise interim bill last week, but with the Congressional adjournment scheduled for late October, there's scant chance of any bill being passed this year.

Meanwhile, developments on the House side are no less convoluted. The Rogers bill, which is more acceptable to biological scientists than the Kennedy version, has been stalled before the Commerce Committee since last July, but it was finally brought up for consideration during the last week in September. To the surprise of virtually everybody, Committee Chairman Harley Staggers (D-W. Va.) began to raise objections to the bill, stating that he had been informed that it would block progress in a vital area of research.

The committee devoted only about 30 minutes to the bill in that session, however, and a second committee meeting was scheduled for a week later. In the interim, staff members of the Rogers subcommittee explained the bill to Staggers and his aides, and they are said to have won his general support for the measure. Unfortunately, however, too few committee members turned up at the second committee meeting for a quorum to be reached. A third session was scheduled for this week.

Jurisdictional Clash

Even if the Commerce Committee does manage to approve the Rogers bill, it still faces another hurdle before it reaches the House floor. The Committee on Science and Technology has claimed jurisdiction over the bill, and it is likely to be referred there for three weeks once it clears the Commerce Committee. Thus, there is now scant chance that the House will act on the bill this year as well.

Some heavy lobbying by biological scientists seems to have been responsible for blocking the legislation. In addition to the petitions and telephone calls throughout the summer, a number of scientists have recently been arguing that there is evidence to suggest that the risks involved in the research are a less than originally feared. In particular, Stanley Cohen, a Stanford geneticist who helped discover the original recombinant DNA technique, has recently been circulating a research paper on Capitol Hill in which he claims that much of the genetic manipulation which scientists can accomplish with recombinant DNA techniques may be occurring naturally. Cohen's paper has yet to be published, however (it has been submitted to the *Proceedings* of the National Academy of Sciences), and Cohen's attempt to disseminate the paper around Congress before his scientific colleagues have had a chance to look at the results represents a disturbing departure from the usual scientific publication procedure.

What effect is the delay likely to have? Until Congress approves legislation, federally funded recombinant DNA research will be governed by guidelines published last year by NIH. The guidelines lack any enforcement or inspection provisions, however, and they do not legally apply to industry.

Lawsuits Pending

There is also another consideration lurking in the background. Two law suits have been filed against NIH in the past few months, claiming that the National Environmental Policy Act has been breached. The first, filed by Friends of the Earth, seeks to halt all federally funded recombinant DNA research because NIH failed to publish a final environmental impact statement before the NIH guidelines were issued. The second, filed by a private lawyer in Maryland, seeks to halt a specific experiment at the NIH research center at Frederick, Md., until an environmental impact statement on that experiment has been published.

Neither suit has been settled. Until recently, at least, NIH officials were hoping that the bill which was expected to be passed by Congress this year would exempt the NIH guidelines from NEPA, thereby making the lawsuits moot. It may soon be possible, however, to watch the recombinent DNA saga in yet another environment — the federal courts.

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Press Urges Realism on Role of Science

Presidential Science Adviser Frank Press earned SGR's High-Vacuum Oratory Award when he ventured to LaJolla , Calif., last month for what was billed as his first "big speech" (SGR Vol. VII, No. 16). But possibly inspired by his old surroundings at MIT — where he headed the Department of Earth and Planetary Sciences before entering government service — Press gave a talk October 8 that merits respectful attention, the reason being that he said a number of things to which both the scientific and political communities should pay heed.

Delivering the First Annual Robert H. Richards Alumni Lecture at the MIT Alumni Officers Conference, Press deftly assailed the science-as-savior school of optimism, the "technological fix" advocates, and the frequent failure to recognize that while science often is, in fact, an indispensable component of solutions to societal problems, it must be harmonized with other, often more powerful, components for achieving desirable results.

Stating that there is a good deal of misunderstanding "involving science and technology and the roles they play in our society," Press said that the "innate optimism" of scientists and technologists often burdens them with unrealistic perspectives.

"Most of us are not cynics," he said. "We tend to believe that for every problem there is a solution. More than that, a great number of us are basically utopian in our outlook. We feel that if a certain number of major problems could be solved mankind could achieve, or come close to achieving, if not heaven-on-earth, at least a decent world community free from most of the conflict and deprivation apparent today . . .

"Over the past few decades," Press continued, "such utopian-like feelings have been reinforced by a series of scientific and technological triumphs that have exalted our spirits and raised new hopes and expectations. Various breakthroughs held different promises: antibiotics would wipe out disease, the atom would be an endless source of energy. The Green Revolution would conquer world hunger . . .

"Where did these miracles of science and technology fail? They didn't," Press declared. "They have all made important contributions — and continue to contribute. What *we* have failed to realize is the nature of the system in which these contributions operate. It is a dynamic one in which new concepts and technologies fulfill and create expectations almost simultaneously. These in turn generate new instabilities and dissatisfactions demanding further change. That change calls

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Expansion of "Futures" Research Recommended for Congress

The Congressional Research Service has issued a review of forecasting and futures research on Capitol Hill.

The review, prepared by William L. Renfro, an analyst in CRS's own futures research group, covers what the field is supposed to be, its value, how it is being used in the Congressional process, some recent Congressional developments, possible developments, and pro and con arguments for methodology. It also lists government sources of information about future studies, including Congressional publications on the subject.

The review suggests that CRS is operating in territory similar to that of the Office of Technology Assessment in assessing trends. For example, CRS is planning a series of papers called "Trend Impact Profiles" which will analyze future developments in various areas. CRS, Renfro reports, is also developing a Futures Information Retrieval System. And since 1975 it has been preparing an "emerging issue analysis" for each new session of Congress.

Renfro sees evolving on Capitol Hill a Congressional Forecasting Office, analogous to the Congressional Budget Office, which already makes impact studies on costs of new legislation. This is how he describes it:

"A CFO might be viewed as providing an analogous function to that served by the Congressional Budget Office in economics — that is, providing forecasts of the likely impacts and benefits of bills and resolutions of a public nature reported to the floor of each House, developing detailed forecasts of non-economic indicators, and otherwise providing the Congress the benefit side of the necessary cost-benefit analysis and tradeoffs it must make." Thus, the futures field is alive and growing on Capitol Hill. Every major House bill now has a forecasting component, or is supposed to, since the House requires forecasts of the implications of its legislation, and the Senate is moving toward the same requirement.

(Renfro's study, 55 pages, is titled "Forecasting and Futures Research in Congress: Background and Prospects." A limited number of copies are available, without charge, from the Congressional Research Service, Library of Congress, Washington, DC 20540).

Carbon Dioxide Threat: Who's in Charge of Monitoring

One of the specific scientific-political issues which Frank Press addressed in his MIT talk was the atmospheric buildup of carbon dioxide as the result of fossil-fuel combustion — a problem destined to become greater as the Administration prods the economy toward greater use of coal.

Until recently, Joel Snow, of the Office of Science and Technology Policy, had been monitoring the issue for OSTP Director Press. But with Snow departing to take a job with the Office of Energy Research at the Department of Energy, the White House is left with no one nearby keeping close tabs on the so-called greenhouse effect. The Council on Environmental Quality likewise has no one in close touch with the network of scientists involved, and finds itself having to play catchup in securing any kind of policy role in an issue that could be a significant sleeper.

Four individuals are at the policy forefront on the CO2 issue: David Slade of the CO2 project office at the Department of Energy is the key figure. His office handles the $1.5 million the Office of Management and Budget has made available for direct research on the subject. Lester Machta, of the National Oceanographic and Atmospheric Administration Air Resources Laboratory, coordinates the actual research. Ralph Rotty is executive secretary of the CO2 advisory panel counseling Slade on research priorities. Rotty is at the Institute for Energy Analysis at Oak Ridge, Tenn. IEA is headed by the former director of the Oak Ridge National Laboratory, Alvin Weinberg, who is the fourth figure of significance. It was Weinberg who brought the issue before Frank Press last spring. Weinberg considers the problem extremely serious and often uses it to make his case in favor of his long-time pet project, the breeder reactor.

The advisory panel is headed by Weinberg and consists of Melvin Calvin of the University of California, Berkeley; Norman Hackerman, president of Rice University and chairman of the National Science Board; Wilmot Hess, director of NOAA's Environmental Research Laboratory; Thomas Malone, head of Halcomb Research Institute in Indianapolis, Ind.; and Ruth Patrick of the Philadelphia Academy of Sciences.

Slade says the goal is to find a permanent staff director "in an institution capable of supporting him." The director would coordinate and guide the scientific program and also be in charge of what Slade calls the "assessment function," or "what the CO2 problem means to man and his institutions." The major federal agencies, along with NOAA, will be the National Science Foundation, NASA, and the Agriculture Department. Curiously, the Environmental Protection Agency is being left out of what could well be the top environmental issue of the next few decades.

. . . Press: Decries "Simplistic" Solutions

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not only for new technologies but also for new social and economic concepts and the institutions to implement them.

"The process," Press argued, "is further complicated by the fact that as long as we are confined to this planet, all this takes place in a world of finite resources and in a closed environment — one in which nature has created a complex and somewhat fragile ecological system . . .

"It is only in relatively recent years that all this complexity and its implications have dawned on us. Now their impact increases every day. And yet it is surprising how many people (scientists included) cling to the hope of simplistic solutions."

Sounding like a convert to the limits-to-growth school, Press chided those who employ "back-of-the-envelope" calculations to establish that the earth is amply endowed with energy resources for all foreseeable needs.

"Such wisdom would seem to indicate there is no energy crisis, merely a few technological problems and restrictions on the free market between us and an energy millenium. But we know differently, and not only in terms of energy but of material resources, food, water, and all other human needs. There are no ultimate or singular technological fixes, nor is everything available or possible simply by providing enough incentives. In this regard, we have lost our innocence. Today we recognize both the enormous engineering and environmental challenges involved in transforming potential resources to realities and the importance of market forces and institutional mechanisms in making our global system work.

"I think we are entering a new age of reality concerning science and technology — what they can and cannot be expected to do in what time frame and at what costs, and with what social and cultural implications. Our frame of reference has expanded manyfold so that today we *assess* technologies to their second and third

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. . . Shift in Science-Technology Relations

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order of effects — economic, environmental, and social — and often even before we know if they will work.

"There is just one more point I should make in this litany," Press said. "That point concerns the actual relationship between our science and technology. And here too I believe our ideas have become more sophisticated. Historically we know that technology predates science as we conceive of it today. In recent years, because of the great surge of successes in basic sciences — nuclear physics, polymer chemistry, molecular biology and solid state research — all of which have led into technologies of great economic value, we have come to feel that the relationship between basic research, applied science and development is a linear one. While there is some truth in this, and much emphasis should be placed on basic research to increase the knowledge capital we need to innovate, we recognize more clearly now how these forces interact.

"In their relationship both drive each other. As new technologies are devised and operate on the basis of the current state of the art they create needs for and gaps of knowledge. They reveal inherent shortcomings that demand material and design improvement, and they create subsidiary problems which call for further scientific research. At the same time advances in basic research — some made possible only through the help of new instrumentation — move science to points where it is able to discover hitherto unsuspected problems with a technology or its effects. Since technological innovation has become a major force in advancing our economy, and since scientific research has given us the means to analyze with increasing precision the state of our environment and our health many of our major science and technology policy issues involve conflicts that develop between the two. In some respects they are both handmaidens and adversaries.

"Such science and technology policy issues are particularly painful — and political. They bring up the matter that cost, benefits and risks are not equally distributed throughout society. They also involve us in assessments leading to essentially Faustian bargains — situations where we commit ourselves to technologies that offer substantial gains but may indebt future generations or bind them to certain longterm obligations — such as the surveillance of nuclear waste. There are also those situations where we must make a judgment, and possibly a commitment, on incomplete or inconclusive knowledge. While these decisions may not be irreversible they can, because of the scope and time of development of the technology, involve such large commitments of rescurces — money, manpower and facilities — that to drop them and change course appears economically catastrophic.

"Yet we must go on making these kinds of judgments. The dynamics of our economy, the pressures of population, social expectations and our position and influence among the other nations of the world demand it."

Clean Air Council in Britain Rejects Ban on Aerosol

Britain's Clean Air Council has advised the Department of Environment not to go along with the American decision to ban the use of chlorofluorcarbons (CFCs) as aerosol propellants. The recommendation is not likely to influence the US plan for a two-year phaseout of CFCs, on the grounds that they damage the ozone layer. But it is likely to hearten those who contend that US regulatory agencies are acting precipitously in similarly disputed cases involving the risks and benefits of popular products.

The Council, which is appointed by the Secretary of Environment to advise the Department on air-pollution issues, stated that "the case made by US regulatory agencies is only one side of the argument. Apart from anything else," it said, "sufficient attention has not been paid to the damage of possible replacement for CFCs."

In making its recommendations, the Council endorsed the UK Government's wait-and-see attitude toward CFC propellants, which calls for efforts to reduce leakage and develop alternative propellants. But the net effect is a rejection of the US decision for an outright ban.

According to the Council, "we do not yet have a full and adequate theory of ozone depletion and its effects on the atmosphere. It is interesting that there has been a 5-10 per cent increase in ozone since the 1920s when measurement began, when according to existing theories man's activities should have decreased the amount . . . It seems clear that natural mechanisms are much more complex than has been supposed in calculations to date. The atmosphere seems to be much more robust and more stable than the models used for predictions."

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Opposition Mounts to French Nuclear Power

Until recently, it looked as if the French nuclear establishment could do no wrong: government policy called for rapid expansion of nuclear power through Europe's most ambitious program, there were notable export successes, and the Phenix reactor led the world in fast-reactor technology. It had been said that the French government left it to the Commissariat a l'Energie Atomique, the CEA (the French equivalent of the old US Atomic Energy Commission), to come up with the country's nuclear policy, and then rubber stamped it.

The picture is suddenly very different. The anti-nuclear movement started late in France, but it has grown so quickly that it is now considered an important factor in the general elections to be held early next year. The planned growth of nuclear power has been reduced — although it remains the most ambitious program in Europe — and the exports of nuclear services and technology, once the goal of all countries, are now viewed

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with suspicion because they appear to have been won with little regard for the spread of nuclear weapons. (Contracts with Pakistan and South Africa have aroused massive international criticism). And following President Carter's stand against the reprocessing of nuclear fuel and the Clinch River fast breeder reactor, the proposed Super Phenix 1300 MWe FBR, due to be built at Creys Malville on the River Rhone, where work has started already, is not quite the envy of the world that it once appeared.

The French anti-nuclear movement made its biggest impact recently when there were violent demonstrations at Creys Malville. One man died, several were injured, and a handful were arrested and quickly processed through the courts with uncharacteristic haste. With the involvement of several thousand West German demonstrators arousing memories of the German occupation of France during the Second World War, it was a highly emotional affair with claims and counter claims of violence and provocation between demonstrators and the police. The "battle of Creys Malville" produced ripples that still have not died down.

A public opinion poll commissioned by the magazine *L'Humanite* and conducted before the demonstration seemed to show a general public support for the government line. But in local elections last March a loosely knit coalition of environmentalists, the Ecologist Party, took 10 per cent of the votes, and the movement's leaders now talk of having 30 per cent of the electorate on their side.

If the Left, which now stands more chance of toppling the government than at any time in the past two decades, can capture these votes it would be in a very healthy position next year. However, the Communist party has adopted a nuclear policy very similar to that of the government. Only the Socialists have shown anything less than complete support for nuclear power and, though they have not come out against nuclear power, they have taken positions designed to attract the Ecologists into their camp. After the Creys Malville incidents, Francois Mitterand, leader of the Socialists, called for a national referendum on nuclear power only to be told by President Giscard d'Estaing that French law limits referenda to constitutional issues. While there are other sensitive issues that have since split the coalition between the Socialists and the Communists in France, their disagreements on nuclear power do not make life any easier.

With its popularity low and falling, the government can no longer afford to leave nuclear policy-making to the CEA. While it still insists that nuclear power is essential for France's future, it is less dogmatic than it was and is now beginning to promote a public debate on the subject.

The French government's belief in nuclear power stems from the country's lack of indigenous energy resources. Three quarters of the country's energy has to be imported. Thus after the dramatic increase in oil prices, the government announced in March 1974 that 40 nuclear reactors would be ordered by 1980. (The program is based on pressurized-water reactors built under licence from Westinghouse.) The original target for 1985 was 60,000 MWe, but following reduced demand for electricity and problems in accelerating the program so rapidly France now intends to have 33,000 MWe in operation by 1985.

A wish to cut energy imports lies behind France's fervor for the fast reactor, which accounts for the recently concluded series of arrangements with West Germany for the development and commercialization of FBRs.

France shares none of President Carter's reservations about fast reactors. Indeed there is some suspicion that had the US not made such a mess of its FBR program it too would be less hesitant about fast reactors. Some European critics of the Carter policy even go so far as to suggest privately that the US wants an embargo on fast-reactor construction so that it can catch up with the European programs.

Until very recently the French government did little to encourage a public debate on nuclear power. It has none

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British Slash Funds for Physics, Astronomy

London. High-energy physics and astronomy have been hard hit by Britain's economic misfortunes over the past four years. But though North Sea oil revenues have brightened the national picture considerably in recent months, it looks as though big science will continue to face a dismal future.

Physics and astronomy are two of the areas covered by the UK's Science Research Council (SRC), a miniversion of the US National Science Foundation, which channels government research funds to universities and government research establishments, as well as the various international projects that Britain is a part of. Professor Sir Sam Edwards has just completed a four-year spell as chairman of the SRC, and his final press conference, launching the SRC's annual report for the year 1976-77, was a gloomy affair. He had, he said, been led to expect the SRC's budget to rise by 12 per cent during his reign, whereas it actually fell by 8.4 per cent, thanks to the disastrous economic events of the past few years.

The SRC's budget last year was just under £130 million ($220 million), of which £30 million (more than $50 million) went to the European Organization for Nuclear Research (CERN) and the European Space Agency (ESA). The government has no firm projections for future expenditure, but the SRC has been advised to work on the assumption that between now and 1981/82 there will be a further 10 per cent drop in the budget. With this in mind, the SRC expects its spending on nuclear physics to fall to about £33 million ($56 million) from £43½ million ($74 million) in 1977/78, with £20 million ($34 million) to be set aside for CERN. Spending on astronomy and geophysics is expected to fall from about £28 million ($48 million) to £23 million ($39 million) over the same period.

However, it isn't all gloom at the SRC: spending on engineering, almost ignored until the beginning of the 1970s, will go up 25 per cent, to £18 million (30 million) over the next four years. And the SRC's spending on the other physical sciences, including central facilities, such as the newly opened laser research facility, where university researchers have access to equipment that is bigger and more expensive than a single university can afford, is expected to rise by about 10 percent, to £25½ million ($43 million) by 1981/82.

The SRC is also responsible for awarding grants to postgraduate students working toward doctorates. Last year the council took some money from research programs so that it could add a further 100 research studentships to the 3300 it had planned to award. The council plans to increase this number to 3800 by 1981/82 but warns that "this increase will not keep pace with the expected rise in the number of qualified candidates so that good opportunities for advanced training will be lost."

Professor John Polkinghorne, of Cambridge University, who is the new chairman of the SRC's Nuclear Physics Board, says that it is ironic that Britain's high-energy physics research has been hit just when the subject is scientifically booming. Quark mania is in the air and there is "a lot going on of fundamental significance," he noted. The UK is well placed to take part in this endeavor, thanks mostly to its membership in CERN. Space research and astronomy are equally exciting at the moment, but they too are hard pushed to make use of the scientific opportunities available.

So far the SRC has survived the cuts better than might be expected — by closing some facilities "rather abruptly," as Edwards puts it, and by cannabalizing existing machines to make new ones. (Two accelerators are providing much of the hardware for a new neutron source and an synchrotron radiation source.) This will not be so easy in the future and the SRC has all but stopped preparing new projects. There is nothing new in the pipeline after the existing projects are finished. But, as Edwards says gloomily, there is "no purpose in spending money doing outline planning and being unable to finance it."

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of the incentives to inform the public that are a part of the American system of government. The growing tide of public concern has forced a change. The government's first move was to agree to hold a debate on nuclear power in Parliament. And toward the end of August, President Giscard d'Estaing announced that he is to set up an information council on nuclear power — ecologists and scientists will be among those invited to join this council.

These moves may, however, be too late. At the beginning of September, the local council in Cherbourg — the port on the English Channel near the site of the Cape La Hague nuclear fuel reprocessing site — came out against further expansion of reprocessing in the area. This attack on reprocessing comes at the same time as Britain is going through an extended public inquiry into plans to expand reprocessing facilities at Windscale in Cumbria, not far from the Lake District tourist area. In both cases, part of the reason for the proposed expansion is to make it possible to reprocess fuels from Japanese power stations — contracts that now look a lot less attractive because of burgeoning anti-nuclear movements.—MK

European Centrifuge Group Eyes US Market

London. A rare success in international collaboration has put three European countries — West Germany, the Netherlands, and the United Kingdom — in the extraordinary position to offer uranium enrichment services to American electricity utilities.

Urenco, the company set up by the three countries to sell enrichment services, estimates that US plans to remove the subsidy on the uranium enrichment business could push up the US's price by at least 50 per cent, putting Urenco's new centrifuge enrichment facilities in a very competitive position.

Europeans had been working separately on the centrifuge for nearly 15 years when, in 1970, the three nations agreed to combine their activities. Urenco was set up with headquarters in England to sell enrichment services, and a companion organization, Centec, headquartered in West Germany, was formed to coordinate R&D.

In comparison with other cooperative ventures the tripartite centrifuge arrangement has been a roaring success, mostly because there was a specific goal and the project was run as a commercial venture. The first fruits of this success were realized in mid-September when Urenco UK officially opened the first quarter of its Capenhurst enrichment plant, which will have a capacity of 200 tons of separative work a year (200,000 separative work units a year) when it is completed next year. A few weeks later, Urenco Netherlands inaugurated the first unit of its plant.

Conningsby Allday, chairman of British Nuclear Fuels Limited, which operates the Capenhurst facility for Urenco, reckons that for uranium enrichment "unless there are government subsidies involved we are quite convinced that true commercial viability lies with the centrifuge." Someone must have convinced President Carter, for he has decreed that the US shall now follow the centrifuge path at the proposed Portsmouth expansion. If nothing else the centrifuge's better energy efficiency — it uses a tenth the electricity consumed by a gaseous diffusion plant to achieve the same output and future centrifuge plants could be twice as efficient again — gives it a headstart in these days of energy awareness. Another big advantage is that a centrifuge plant does not have to be built to a gigantic scale before it can begin commercial operation. Centrifuge technology is such that these plants can be built a bit at a time.

When Urenco/Centec have completed their current program they hope to start on new facilities that will expand their output substantially. Urenco has orders worth nearly $2 billion up to 1991.

Urenco's plans to expand into the American market could easily be upset by political moves — Europeans are generally confused by President Carter's policies in this area, and the motives behind them — but the company believes that it has a strong commercial case. It will certainly be some time before the US completes its planned centrifuge facilities. Urenco has hired a Washington-based company of consultants, International Energy Associates, to advise it on the US markets.

Commercial security has limited the flow of information between the US and Europe on centrifuge technology, but it seems clear that the two have taken different paths in their R&D. The US has, so far, favored large machines with poorer reliability. This trade off of lower manufacturing costs for higher servicing costs may now be abandoned as the US, according to European observers, switches to their approach, which is to build huge numbers of extremely reliable centrifuges. Urenco's failure rate has been around 0.3 percent a year, a third of the design level. The key elements in the European program are the centrifuge manufacturing facilities. And while technologists in Europe have previously fallen down when it comes to converting their ideas into a finished product, this time they seem to have brought it off.

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